Integrated Water Quality and Aquatic Communities Protocol – Wadeable Streams

Standard Operating Procedure (SOP) #6: Site Arrival and Sample Reach Layout

Draft Version 1.0

Revision History Log:

Previous Version	Revision Date	Author	Changes Made	Reason for Change	New Version

This SOP explains the immediate tasks that need to be completed upon site arrival and includes the miscellaneous tasks associated with sampling that may not be included in other SOPs.

To reduce the possibility of transporting disease and exotic organisms to other sites, crews should keep their aquatic footwear and trail footwear separate. Upon reaching the proximity of the site, the crew should remove their hiking footwear, and don their aquatic footwear. Their hiking footwear should be left away from the aquatic habitat, to be used when all aquatic sampling is complete. Daily disinfection of aquatic footwear and sampling gear is crucial to prevent the spread of organisms between sample reaches as a direct result of sampling activities (SOP #17: Post-Site Tasks).

Locating the Sample Reach

The day prior to sampling the reach, the Field Crew Leader should identify the reach to be sampled. This will either be predetermined based on previous field season sampling or, if in the first year of implementation, there will be considerable flexibility in choosing the reach. Since accessibility of the reach will be unknown in the first year, alternate reaches should also be selected, in the order of the GRTS draw for the site (SOP #3: Site Selection).

Field crew members should use local road, trail, park atlases (if available), topographic maps, and/or premade GIS maps to determine the location of the sample reach that is to be sampled and the best route to gain access. Using a Garmin 60/76CSx (or similar) GPS handheld device, preloaded with site coordinates and navigational features such as streams, ridges, roads, and trails (SOP #1: Preparations, Equipment and Safety), they should navigate to the site using available pathways. A waypoint should be recorded at the vehicle location to ensure efficient navigation back to where the vehicle is parked.

The crew should be prepared to use alternate routes of travel, as unexpected events such as the closing of roads and trails may make the planned route invalid. The GPS device should be the primary source of navigation from the location of the field vehicle to the location of the sample

reach. However, electronic gear should not replace standard route-finding techniques and awareness. Field crew members should always remember to carry a compass, list of site coordinates, and maps pertinent to the sampling event in a waterproof zip-top bag in case of GPS equipment malfunction. Such malfunctions may occur in areas of dense canopy cover, which hinders communication with GPS satellites or other equipment failure.

The sample reach will be defined as a linear length of stream; however, the GPS coordinates direct the crew to an "X-point," located in the center of the reach (Figure 1). The X-point is calculated from the National Hydrography Dataset (NHD) and error between the NHD and the GPS may place the X-point as much as 50 meters away from a flowing stream. In these cases, or in any other case where the X-point does not land directly in the streambed, the crew should make a straightline to the nearest flowing stream and establish that point as the X-point.

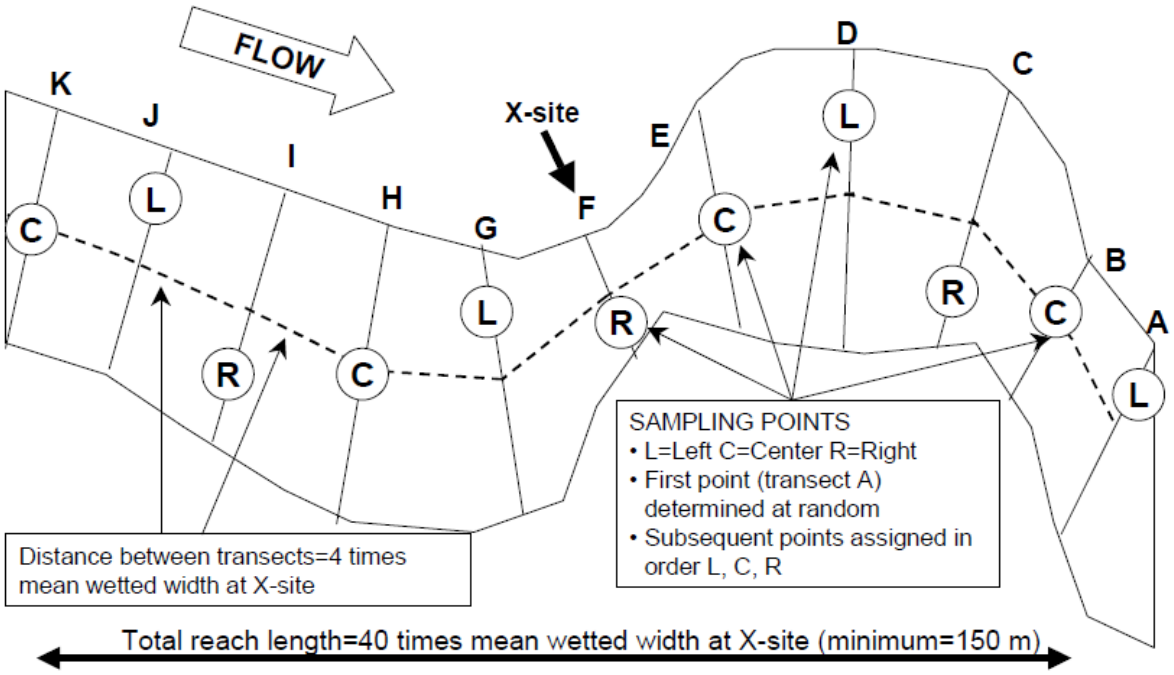

Figure 1. Schematic overview of the reach layout, showing the "X" point at the F transect and the center of stream line used to measure the distance between transects. From EMAP Western Pilot Study Field Operations Manual.

Establish a Working Area

Upon arriving at the midpoint coordinates for the proposed stream reach, the Field Crew Leader should scout the stream by walking around and observing the majority of the proposed stream reach area. Care should be taken not to walk through the aquatic environment to be sampled, as this may disturb fishes and macroinvertebrates as well as affect water quality measurements. The purpose of this scouting is to ensure that there are no limiting features within the reach area that may be dangerous to crew members, may too greatly impede the progress of sampling procedures, or may cause certain areas of the reach to be unsampleable. Certain features may be judgment calls; it is up to the Crew Leader to determine if high quality data can be obtained, but

recognizing that crew safety should always be the primary consideration. Limiting features include, but are not restricted to:

a. Log-jams.
b. Confluences with tributaries.
c. Lakes, reservoirs, or ponds.
d. Large waterfalls.
e. Deep pools.
f. Dense, impenetrable vegetation.
g. Impassable rugged terrain.
h. Large boulders/rockslides.
i. Large areas of dry streambed, especially if judged to be of ephemeral nature.
j. Indications of marijuana cultivation.
k. High stream discharge events.
    i. Avoid sampling during high flow/ rainstorm events. If the stream is running at or near bank full discharge or water seems much more turbid than typical for the class of stream, do not sample that day. Do not return to sample the stream for a period of at least 14 days.
    ii. If the stream seems to be close to normal summer flows and does not seem to be unduly influenced by storm events, proceed with sampling events, even if it has recently rained or is lightly raining. The Crew Leader should keep track of local weather conditions to assist in the planning of the day's activities.

If, after scouting, it is determined that the proposed stream reach is unsuitable for sampling in its current state, the Crew Leader should attempt to find an alternate reach to be sampled from the list of alternate reach GPS coordinates. Alternate reaches should be considered in the order that they are listed, unless the location suggests similar constrains (same part of park with high flows, late lying snows, etc.). **The reason for alternate reach selection should be recorded in the "General Comments" section of the Stream Verification tab or form.**

If by adjusting the X-point upstream or downstream, limiting features can be avoided, the Crew Leader can slide the X-point a maximum of 100 meters. If 100 meters is not adequate, the reach is declared unsampleable and alternate reaches are selected. If shifted, the coordinates of the new X-point are recorded and documented. If a tributary is found, mark it as one of the end points and slide the other end the appropriate distance. Do not slide so that reach is in a different stream order than the location of the X-point. If a lake or other lentic water body is encountered, mark that as the end point and likewise, slide the reach.

Establish a streamside workspace near the X-point of the stream reach. Find a flat, shady area, as free of debris and excess vegetation as possible.

Establish an area within the stream from which water quality and water chemistry data can be collected. The water in this area should be:

a. Well mixed, but not turbulent (SOP #7: Water Quality Sonde Calibration and Field Measurement has more guidance).
b. Adequately deep for sampling (able to completely submerge a sample vial).

c. Undisturbed by crew members.
d. Free of obstructions such as woody debris, boulders, macrophytes, and dense algae.

Preparing Gear and Equipment

1. Set up a water chemistry processing area in the shade. Using a pack towel or small tarp, arrange an area that will be debris/dirt free to minimize/eliminate contamination during water chemistry processing.

2. Unpack remaining gear in the established workspace, minimizing "gear scatter" or the dreaded "garage sale." Keep things organized for specific tasks; keep smaller items together in work vests or small bags to prevent loss; and keep electronic gear out of the sun as much as possible, a safe distance from water, and so located to prevent them rolling or sliding into the stream. If shade is limited, place gear underneath field packs. Assess and anticipate the solar and shade paths to ensure that sensitive gear will stay in the shade through the sampling period, if possible. Unpack items only as needed and return items back to the workspace when no longer in use. Electrofishing gear should be assembled and calibrated according manufacturer's directions (SOP #15: Aquatic Vertebrate Sampling).

Prepare and Pre-label Sample Vials

This is a procedure that can be done prior to arriving at the site (e.g., the member who is not driving can do this during transit or it can be completed the night before). If it has not been done prior, it should be done upon site arrival. Because the needs of the labels depend on the SOP (e.g., water samples versus invertebrates), the needs are detailed in later SOPs. Always keep adequate supplies of unlabeled jars/vials and blank labels available in case of labeling error or break/loss of a sample container. In the event of breakage, gather all glass shards into a safe container and pack back to the vehicle; do not leave on site. Labels should be made using an electronic label maker, with print impervious to Ethanol. Backup methods of labeling are specified in later SOPs.

Preliminary Data Recording

1. Begin to fill in the Stream Verification form on tablet computer, following the procedures outlined in SOP #4: Data Entry.
    a. **Record** the site name and the unique site code. The site code will be predetermined by the KLMN Network GIS Specialist.
    b. **Record** the date (use the default electronic format, or yyyymmdd format [e.g., 20081121 for the 21st November 2008]) and arrival time (use 24 hour time) if recording on a paper data form.
    c. **Record** the trails and roads used to access the site and the time taken for each.
    d. **Record** the crew names and any additional observers (e.g., park staff).
        i. Do not record "Bob" or "Nancy." Spell out full first and last names. Do not abbreviate the first name (e.g., use Sean Smith instead of S. Smith).
    e. **Record** whether or not the site was able to be sampled and the reason for this determination in the appropriate box. If using paper forms, carry additional Stream Verification forms in the clipboard to be used in the event that a stream

reach was unable to be sampled. Complete this form in its entirety in the case of alternate reaches deemed unable to be sampled as well.

f. **Record** the Latitude/Longitude of the X-point in degree decimal format using the handheld GPS unit. Ensure that the datum is NAD 1983.
g. **Record** total reach length and an approximated average stream width used to determine this distance.
    i. Reach length is determined according to EMAP rules where an average width is estimated for a portion of the reach near the X-point by taking five width measurements upstream and downstream of the X-point using transect tape. The total reach length is determined by taking this average width (rounded to the nearest whole number) and multiplying it by 40. The minimum acceptable reach length is 150 m and the maximum is 500 m (for reaches with average widths greater than 12.5 m, the maximum reach length is used in order to prevent a reach that is too long, thus unnecessarily delaying sampling activities due to increased travel time among the transects).

Setup Stream Transects

Eleven equidistantly-spaced transects (each transect being [0.1 X Reach Length] m apart) are measured and flagged using survey flags or flagging tape that are labeled with the individual transect letter designations (Transects A-K). The distance between transects is measured by transect tape following the contour of the stream, not the straightline distance measured from the shore (i.e., do not "cut corners") (Figure 1). The measurement of distance between transects may involve being inside the stream channel, which can disturb water quality and water chemistry measurements; this should be minimized. Therefore, begin at the X-point (which is Transect F) and lay out the stream reach moving downstream towards Transect A, which is the furthest downstream transect. Return to the X-point and be certain that all water quality and water chemistry measurements are complete before continuing to lay out the stream reach moving upstream towards Transect K, which is the furthest upstream transect. Do not conduct any sampling activities upstream of the X-point unless a crew member has already completed water quality analysis and collected water samples. Scouting is the exception to this rule and should be done only by the Crew Leader, taking care to not disturb the stream channel. It is acceptable to move onto other tasks (i.e., Pool/Riffle/Run Categorization or Reach Slope measurement) to allow for more time for other crew members to complete water quality and water chemistry measurements, so long as the reach length is fully laid out shortly after the completion of these measurements.

Macrohabitat Characterization

This procedure quantifies macrohabitat features by describing the length of these features within the sampling reach. Starting at Transect A (0 meters), walk along the stream reach and approximate the length of these features using inter-transect as a guide. For example, if from Transect A the first 8 meters are a pool, the next 20 meters a glide, and the next 15 meters a riffle, you should record this as 0-8 m in the pool column, 8-28 m in the run column, and 28-43 m in the riffle column. Continue describing these lengths of these features ending at Transect K ([total reach length] meters). In case of side channels within the sample reach, describe the

dominant habitat that is located in the stream channel through which the majority of flow is coursing, ignoring habitats in the side channel with lesser flow.

There are four categories of macrohabitat features. These four categories are columns of the macrohabitat characterization portion of the "Site Verification" datasheet. These are defined as:

1. Dry: An area of dry stream bed with no surface water. Subsurface flows may be present.
2. Riffle: A shallow part of the stream where water flows swiftly over completely or partially submerged obstructions or substrates to produce turbulence and surface water agitation.
3. Glide: A relatively shallow part of the stream with moderate velocity and little or no surface turbulence.
4. Pool: A relatively deep part of the reach with low water velocity and little or no surface turbulence.